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## (54) Ball valve incorporating double check valve

(57) A ball valve unit comprises in combination a valve body (17) having a central chamber (18) for a spherical plug (19) connected to a control spindle (28) to rotate between an open position in which a main passage (20) in the spherical plug (19) communicates with inlet and outlet conduits (22, 24) of the valve body (17) provided with check valves (25, 26), and a closed position in which the outlet conduit (24) communicates, via aperture (31), passage (20) and chamber (18), with a check opening (29) in the valve body. Thus, any leakage via check valve (26) can be detected by removing stopper (30). The inlet and outlet conduits (22, 24), the opening (27) for the control shaft and the check opening (29) being delimited by conical or cylindrical surfaces having decreasing diameters along converging machining directions.

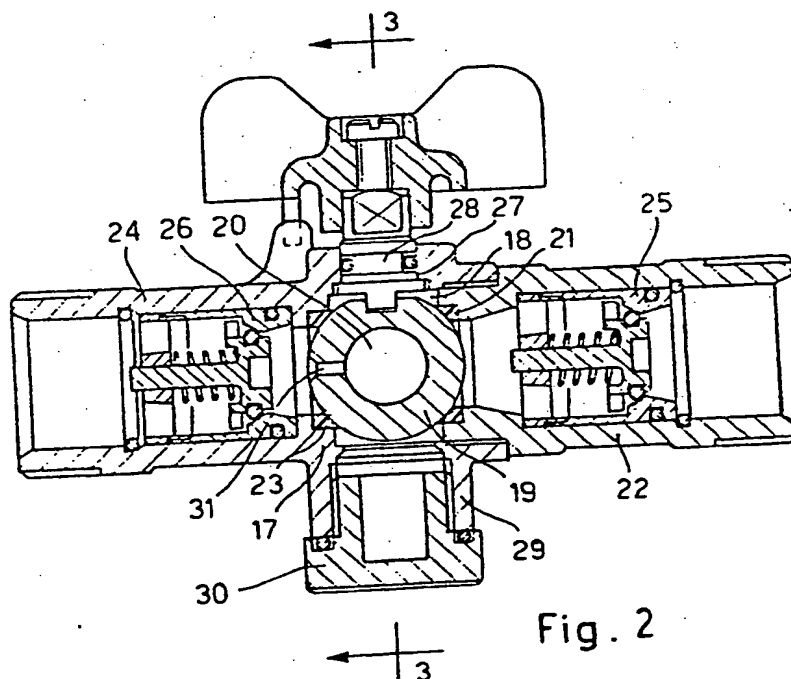


Fig. 2

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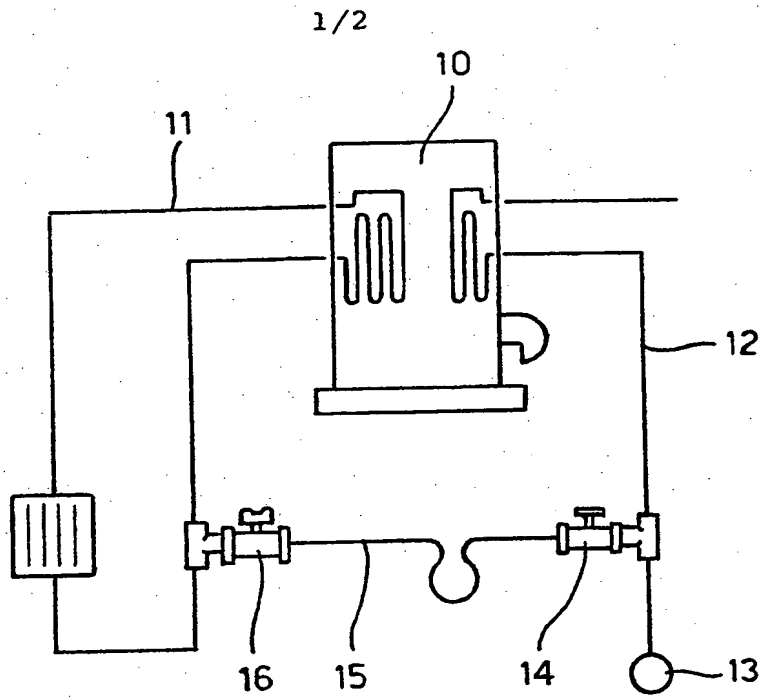


Fig. 1

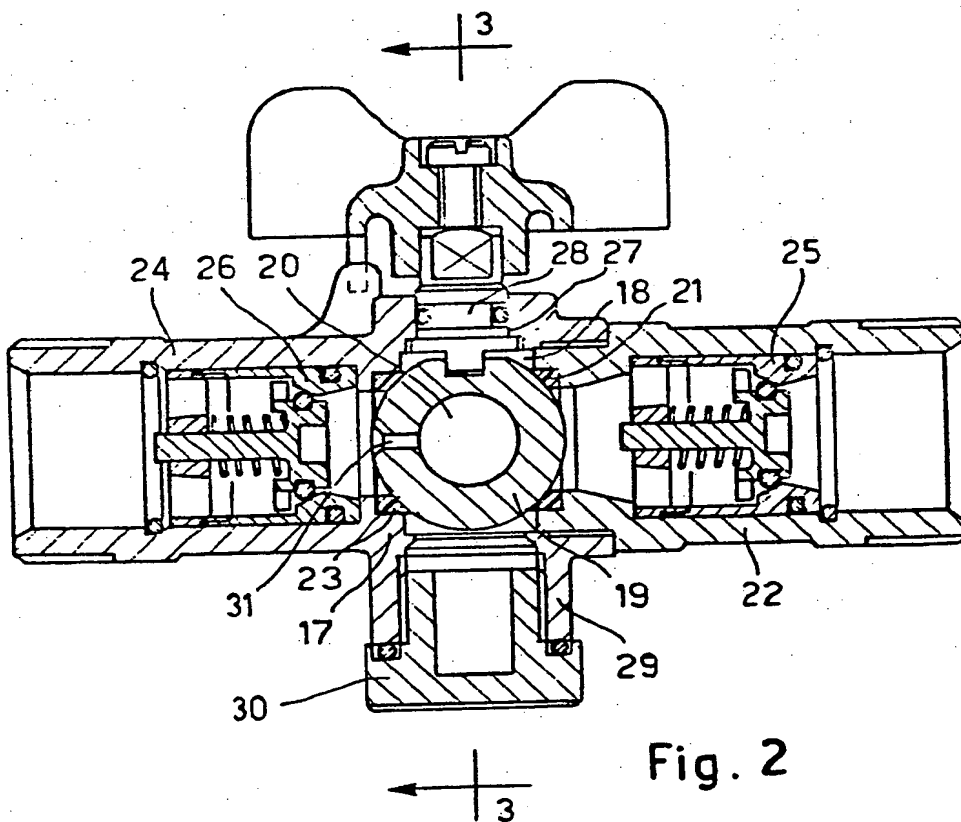


Fig. 2

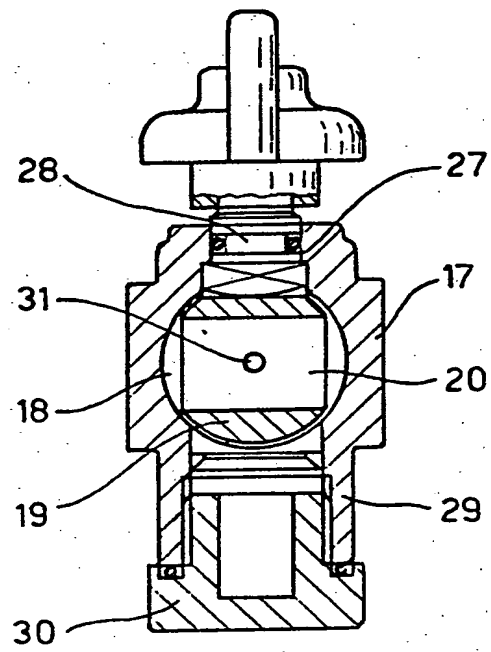


Fig. 3

**BALL VALVE INCORPORATING DOUBLE CHECK VALVE**

This invention relates to a ball valve comprising a double check-valve system acting on both the input and output conduit, to connect closed hydraulic circuits, for example heating system circuits, to a water-supply network or to a water source to which said closed circuit must be periodically connected.

A number of standard regulations stipulate that closed hydraulic circuits, in particular heating system circuits, must be connected only temporarily to a water supply network or to a water supply conduit, for example to fill the hydraulic system or for periodic replenishment needed to compensate for leakage. However, the same standards allow the permanent connection of open circuits for distributing hot water for sanitary use.

A water heater may be used both for supplying hot water to the heating system's closed circuit and for supplying hot water for sanitary facilities. Additionally, both these circuits are usually connected to the same water-supply network feed pipe. For this reason standard regulations require that the connection between the water-supply network and the heating system's closed circuit be effected through hosing that can be disconnected and by a stop valve or cock comprising a system of two check valves that prevent any backflux of water from the heating system

to the water-supply network or to the sanitary water circuit.

At present various valve units suitable for the above-stated function are available. However, their structure and manufacture is extremely complex. Furthermore, they necessitate various work cycles that cannot be performed on an automatic machine without having to remove and reposition the workpiece - so incurring risk of errors and lost time.

The object of this invention is to provide a valve unit for the above-stated use comprising a double check valve and a check system, while at the same time being extremely simple, fairly compact, and inexpensive to manufacture using operations carried out in sequence on an automatic machine without each time having to remove or reposition the valve body during machining.

What has been stated above can be achieved using a ball valve unit according to this invention comprising the following combination: a valve body defining a central chamber having a longitudinal axis, and a spherical plug connected to a control spindle, said chamber communicating both with a first input conduit comprising a sleeve member that screws on to one end of the chamber, and an output conduit forming part of the valve body at the end opposite to said input conduit, said input and output conduits being axially aligned with the valve body's central chamber;

annular sealing elements for the spherical plug being positioned in the chamber in correspondence to said input and output conduits, the valve body additionally comprising an upper opening through which the plug control spindle passes and a lower opening communicating with said chamber, said lower opening being closed by a stopper and being axially aligned with said upper opening along a coplanar axis at right angles to the central chamber's axis; said central chamber, said input and output conduits and said upper and lower valve-body openings being defined by cylindrical and/or conical surfaces having decreasing diameters along three working directions converging with respect to one another along the previously stated axes.

The ball valve according to this invention will be further described below with reference to the appended drawings, in which:

Figure 1 is a diagram showing a heating system including the ball valve according to this invention;

Figure 2 is a longitudinal cross-sectional view of the ball valve when in its control condition with respect to the check valve on the output conduit;

Figure 3 is a cross-sectional view along the line 3-3 in figure 2.

Figure 1 shows a general type of heating system comprising a water heater 10 having a main circuit 11 of the closed type for heating systems, and a

secondary circuit 12 for supplying hot water for sanitary purposes. Both circuits 11 and 12 are connected to the water source of a supply network 13 in the way shown; in particular, the secondary circuit 12 for the hot sanitary water is directly connected to the supply network 13, while the heating circuit 11 is connected via a cock 14, a hose 15 and a valve 16 according to this invention. The heating circuit 11, according to the aforesaid standard regulations, must be connected only temporarily to the water-supply network 13 in order, for example, to fill the system or add to the water during operation. Accordingly, the hose 15 must be capable of being disconnected from the valve 16 and, consequently, the latter must be provided with a double non-return system or check valves to prevent the water in the heating circuit 11 - which frequently contains additives or other highly polluting substances - from returning to the water-supply network 13 or to the circuit 12 for hot washing water.

Therefore, according to this invention, there is provided a ball valve incorporating a double check-valve system, said ball valve comprising a valve body 17 provided with a cylindrical chamber 18 for a spherical plug 19 having an axial passage 20 for the fluid.

On one side of the plug chamber 18 there is a first annular sealing element 21 positioned in a

seating at the end of a sleeve member 22 that screws partially into the plug chamber 18 and which defines an input conduit to the valve. A second annular sealing element 23 is positioned in a seating at the opposite end of the plug chamber 18, in correspondence with the valve's output conduit 24 forming part of the same valve body 17.

A first unidirectional check valve 25 is positioned inside the input conduit 22. Similarly, a second unidirectional check valve 26, oriented in the same direction as the previous one is positioned inside the output conduit 24. The input conduit 22, the output conduit 24 and the plug chamber 18, as shown are axially aligned with respect to one another.

The valve body 17 additionally comprises a first upper opening 27 through which the control spindle 28 of the spherical plug 19 passes, and a second lower opening 29 for controlling the check valves and which is usually closed off with a stopper 30. The openings 27 and 29 are axially aligned at right angle to the main axis of the valve by the conduits 22 and 24, and by the plug chamber 18.

A stopper 30 is screwed into the lower opening 29 of the valve body and, if need be, may be removed for verifying the check valves sealing, especially that of the output conduit's check valve 26. Accordingly, the spherical plug 19 of the output conduit has, at right angles to its main passage 20, a



transverse hole 31 which in the condition shown in figure 2 allows the output conduit 24, upstream of the check valve 26, to communicate with the spherical plug's internal passage 20 and therefore, as shown in figure 3, with the plug chamber 18. Accordingly, by unscrewing the stopper 30 it is possible to verify whether the check valve 26 is working or leaking.

As already stated, the axes of the valve and in particular the axes of the input conduit 22, of the output conduit 24, and of the plug chamber 18 are mutually aligned and at right angle to the axes of the valve body's upper and lower openings 27 and 29. Therefore, according to this invention the valve body may be manufactured extremely economically through a series of operations that may be easily carried out in sequence on automatic machines so that the plug chamber 18, the output conduit 24 and the upper and lower openings 27 and 29 are delimited by cylindrical and/or conical surfaces having decreasing diameters whose related machining operations are directed so as to converge or be oriented along the previously stated axes. As a result these operations may be easily performed on an automatic machine with three working axes - at a distinctly modest cost in time and money. In addition, the presence of a lower opening with a corresponding closing stopper allows the check valve's functioning to be verified at any moment. This guarantee the orderly functioning of the valves, so

eliminating any danger of fluid passing from the circuit 11 of the heating system or in general of any user to the water-supply network or a water source that must not be contaminated. The solution proposed has proved to be extremely effective and reliable.

# CLAIMS

1. A ball valve unit comprising in combination a valve body defining a central chamber having a longitudinal axis and a spherical plug having a main passage, said plug being connected to a control spindle, said chamber communicating with a first input conduit comprising a sleeve member that screws to one end of the chamber, and of an output conduit forming part of the valve body at the end of the chamber opposite said input conduit, said input and output conduits being axially aligned with the valve body's central chamber; annular sealing elements for the spherical plug being positioned in the chamber in correspondance to said input and output conduits, the valve body additionally comprising an upper opening through which the plug control spindle passes and a lower check opening communicating with said chamber, said lower opening being provided with a stopper and being axially aligned with said upper opening along a coplanar axis at right angles to the central chamber's axis; said input and output conduits and said upper and lower openings of the valve body being delimited by cylindrical and/or conical surfaces having decreasing diameters along three working directions converging with respect to one another along the above-mentioned axes.

2. A valve unit as claimed in claim 1,

characterised by the fact that said lower opening of the valve body is provided with a closing member and by the fact that the spherical plug, when the valve is in the closed condition, has a passage oriented towards the output conduit, which allows the latter to communicate with the valve body's lower check opening.

3. A valve unit as claimed in claim 2, characterised by the fact that said passage is provided by a transverse hole formed in the wall of the spherical plug.

4. A valve unit as claimed in claim 3, characterised by the fact that said transverse hole is directed at right angles to the main passage of the plug.

5. A valve unit as hereinbefore described with reference to and as illustrated in the accompanying drawings.